46TH CONGRESS, 2d Session. SENATE. MIS. DOC. No. 39.

MEMORIAL

OF

DANIEL RUGGLES,

ASKING

An appropriation, to be expended in developing his system of producing rainfall.

FEBRUARY 12, 1880.—Referred to the Committee on Agriculture and ordered to be printed.

To the honorable the Senate and the House of Representatives, in Congress assembled:

Your petitioner, I, Daniel Ruggles, a citizen of the city of Fredericksburg, Va., respectfully represent:

That I have invented a method for condensing clouds in the atmospheric realm, and for precipitating rainfall from rain-clouds, to prevent drought, to stimulate and sustain vegetation, to equalize rainfall and waterflow, and by combining the available scientific inventions of the age, to guard against "pestilence and famine," and to prevent, or to alleviate them when prevailing. That I respectfully submit, for the consideration of your honorable body, the following explanatory views:

That my invention contemplates an "advance step" in the science of meteorological engineering.

That since the expulsion of our great progenitor, Adam, from his terrestrial paradise to the present hour, agriculture has constituted the basis of the world's industries.

In this connection I propose to notice those atmospheric laws, theoretical and practical, involving drought and controlling rainfall.

In the mosaic record we find that the atmosphere, the firmament, the celestial realm, stands revealed to man as one of the first great evolutions of the Omnipotent Mind. (Gen. i, 6, 7).

From the same divine source we derive an early lesson in philosophy, that "the Lord had not caused it to rain upon the earth, and there was not a man to till the ground." (Gen. ii, 5.)

"But there went up a mist from the earth, and watered the whole face of the ground." (Gen. ii, 6.)

"And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul." (Gen. ii, 7.)

"So God created man in his own image, in the image of God created he him; male and female created he them." (Gen. i, 27.)

"And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth." (Gen. i, 28.)

Thus we behold our sphere, in its grand celestial orbit, as it fell from the hand of Creative Wisdom.

History, both sacred and profane, admonishes us that the vicissitudes attendant upon drought menace almost continuously vast regions of the habitable globe. History, as well as observation, also admonishes us that man is neither aërial nor amphibious, but a land animal; that he walks the earth, breathes the air, drinks the waters, and that by his impulsive genius and indomitable energy he has attained dominion, more or less imperfect, over large areas of the earth's surface; a limited control over the sea, and some familiarity with, but a far more limited control over, the atmospheric realm. Even the divine injunction to man to "replenish the earth and subdue it" would seem to have been prophetic only of the progress of the ages. History, both sacred and profane, illustrates by what slow degrees man has advanced in the subjugation of the earth, dominion over the sea, and in the conquest of the atmospheric realm. Each advancing step has constituted an era in human progress. Like the blind man in a dream it has taken a step in advance and then faltered. In his infancy the savage imitates the fish in swimming and disports himself upon the waters. The development of this faculty constitutes, however, only the first step in man's advancement. It facilitated his migration among the fishing-streams and hunting-grounds of the primeval wilderness, *but he was still a savage!* He invented the *canoe*, which constitutes an admirable triumph of human art.

The genius of man has been brilliantly illustrated in the progressive stages of development of this primeval invention in all its varied forms. In the small canoe, cut from the trunk of a forest-tree or fashioned from the strong bark of the birchen tree, we trace the origin of this inspiration of savage genius. Such was the magic bark, bearing in prehistoric ages the solitary hunter and fisherman. In the progress of time each structure of canoe acquired a capacity to bear scores of savage warriors on the war-path against hostile nations.

Necessity was then, as now, the mother of invention. Primeval man invented the bow and the arrow; also a transcendant achievement of savage genius.

It is claimed that the art of fabricating stone axes, flint arrow-heads, &c., has been recently discovered, as supposed to have been practiced by the prehistoric races of men. Hitherto, this process has been a mystery, a stumbling-block to the scientific world. Hence, the inference is drawn that the primeval races neither knew nor employed *iron or bronze*, which has long been learnedly contested.

With the *bow and the arrow* the savage has, throughout the ages, made game of "every living thing that moveth upon the earth," and made war upon his fellow-savage also. As time rolled on, he contended for his natural and inherent rights with semi-barbarians and with civilized man, as impulsive and arrogant intruders. He has ever displayed such indomitable prowess as to induce those who employ our best fire-arms to ponder well upon those points of assumed superiority. He invented the snow-shoe, also, which enables him to pursue the chase in a frigid, zone, in the midst of the drifting snows of winter. Such were the material triumphs of *savage genius!* Such, indeed, was the savage state of the great mass of mankind throughout vast regions of the groaning globe during an immense range of the primeval ages, when man advanced by as slow degrees in self-conquest and in self-culture as in the fulfillment of the divine injunctions "to replenish the earth and subdue it."

The long-promised millenial era had not then dawned when the proud

Caucasian shall embrace, with Christian cordiality, the "heathen Chinee."

The art of navigation developed by slow degrees, has been derived from a mixed origin—civilized and savage. In its most advanced form *it stands among the sublime triumphs of human genius, courage, and energy.*

It has been plausibly assumed that, "having by his skill achieved the conquest of the waters that compass the habitable globe, it was natural for man to desire, likewise, the mastery of the air in which we breathe."

"The conquest of the waters," thus assumed to have been accomplished, presents a *decidedly superficial view—merely skimming the seas and not extending to the profoundest depths!*

From creation's dawn to the Christian era, has been assumed as 4004 years, and since then 1800 years elapsed before steam-power moved upon the face of the water—first upon the waters of the placid Hudson, in the midst of its picturesque banks of beauty, in 1807; then the beautiful Ohio, and the magnificent Mississippi, in 1817.

Let us contemplate, momentarily, the immobility of the commerce of the world, then, as a type of passed and almost forgotten eras.

During the revolutionary war horse-mails were sent from Philadelphia to New York and Boston! Until about the year 1830, the speed of the horse on the American continent, and that of the camel on the Eastern continent, was, on land, the greatest known. Ships at sea were then propelled exclusively by sails spread to the fitful breeze.

The navigation of the western rivers had been, then, until within a recent period, confined mainly to barges and flatboats floating down their currents, to find markets, and returning up these rivers by *the use of oars and setting-poles!*

The ocean, then, had not been spanned by steam. An Englishman, Dr. Lardner, of scientific fame, declared that it was impracticable for a steamship to carry sufficient coals to make a voyage across the broad Atlantic!

Within ten years the steamship Great Western made regular trips across the ocean.*

Thus much for the *theoretical* and a *premium* for the *practical!*

The invention of the magneto-electric telegraph followed, and has become the magic voice of the nations. Since then steam and the telegraph have revolutionized the commerce of the world, and expanded, as if by a magician's wand, the great field of our industries.

Great Britain, with a population of forty millions, employs steam as a motive force equivalent to the physical power of 600,000,000 of men, and that of the United States is rated as equal to 400,000,000 of men!

Had these potent forces been developed during the full century just ended, and been employed as engines of war, much of the world's

*On the 8th day of June, 1879, the new steamship Arizona arrived in the city of New York in seven days and twelve hours from Liverpool. The captain stated that he could make the return-trip in less time. This noble steamship recently encountered an iceberg in making a return-trip. The departure of five steamships from New York for Europe, in one day, has recently been repeatedly noted. May we not justly claim that the leviathan, steam, directed by American inventive genius, now "rules the main!"

In this grand commercial triumph the people of Virginia, especially those of our time-honored city of Fredericksburg, recognize a noble tribute to the practical genius of one of her gifted sons, now passed onward to those realms where "laurels celestial ever bloom."

To the late Commodore Matthew F. Maury, of scientific fame, the commercial world owes perpetual gratitude for having *pointed out the great pathways of the ocean, and for his interpretation of the laws of ocean storms.*

history would have been reversed, modified, or expunged. The influence and the results of the recent great civil war within our own borders confirm this view, as well as the Napoleonic maxim, that "Victory crowns the heaviest artillery."

Steam is still on the march conquering and to conquer, while, as yet, commerce merely skims the seas.

What triumph of genius is still impending? All agree that the conquest of the atmospheric realm has not been achieved; although the genius of man has been enlisted in all ages in unsuccessful attempts to fly, and modern persistent attempts to navigate the aerial realm for the attainment of great industrial and commercial benefits seem to have proved thus far equally abortive.

The navigation of the waters—as an inelastic liquid—contrasts strongly with that of the highly elastic fluid or aerial realm. The ship rides upon the waters propelled by wind or steam, while the balloon is tossed immersed in an elastic fluid, involving novel conditions, which practical science has not as yet apparently mastered. There is scarcely room for doubt, however, that when the atmospheric laws shall be fully understood, and their capabilities appreciated, science will crown the efforts of genius in the accomplishment of aerial navigation.

In its varied forms the balloon has already superseded all other methods ever employed to navigate the air, and even now discloses the capabilities requisite for the execution of my plans and purposes in communicating with the cloud-realm.

It is contemplated in the prosecution of my invention to combine the scientific revelation of the age in which we live—so far as may prove available—to control the cloud realm by claiming and exacting a passing tribute, under favoring conditions, to sustain and stimulate vegetation, to prevent pervading and desolating drought, and to extract from the soil its natural increase. This result, even imperfectly attained, would tend materially to alleviate famine, and often to prevent its occurrence, and would thus become a boon to mankind.

The triumphs of the genius of invention warrant a well-grounded hope that this great object, as well as others—never conceived and never tried—may be speedily attained.

THE BALLOON.

The practicability of sending balloons, carrying torpedoes charged with dynamite and other powerful explosives, into the atmospheric realm, and then to explode them, appears to be so fully established by analogous experiment that actual failure in a well-devised attempt only would legitimately encourage doubt.

The characteristics and capabilities of the balloon, and the history of its triumphs already achieved, combining romance, reality, novelty, danger, and death, within a brief and startling, and, indeed, but too often tragic scene, have invested it with an intense and superstitious interest, which has probably somewhat obstructed its successful employment in the promotion of the world's industries. Its field of action, embracing as it does the atmospheric realm, so far as it is accessible to man, corresponds with that in which my invention aims to attain its contemplated triumphs. Thus far, indeed, our knowledge of the cloud-realm has been derived, in a great measure, from aeronautic observations, sometimes taken with *scientific accuracy, by men of ability and a high order of attainments*, and at others, by an *adventurous class of aerial privateersmen.*

A rapid notice of some of the results of aerial exploration presents

some salient points of peculiar interest, and especially in connection with the characteristics of my contemplated field of action.

It may be expedient to note, as a preliminary, that it is proposed to send into the aerial realm only small, inexpensive balloons, except when a reconnaissance is desired, and then no one but an experienced aeronaut would be permitted to essay so important a service.

THE RAIN-CLOUD BALLOON.

In the prosecution of my plan only small skeleton balloons of economical or cheap structure will be required, and—

1st. The small, light, skeleton balloon to carry into the cloud-realm from one to fifty pounds of dynamite, or other explosives, in torpedoes or cartridges charged with them in carefully-regulated proportions, and prepared for detonation and simultaneous explosion by the time-fuse, securely attached to the framework of the balloon.

This class of balloons, charged with hydrogen gas—from 100 to 1,000 cubic feet—would ascend in ten to twenty minutes 10,000 to 12,000 feet, with from 10 to 100 pounds of explosives, into the midst of floating rain-clouds, ready for explosion by the time-fuse.

The same class of balloons may be arranged for explosion by mechanical or clockwork arrangement.

2d. The balloon of any desired capacity, bearing torpedoes and cartridges prepared for simultaneous explosion by a combination of a trailing-drag with magneto-electric force in the cloud-realm.

3d. The balloon, directed by an aeronaut engaged in exploration, from which torpedoes may be thrown in parachutes and exploded from the balloon or from the ground, as circumstances may render expedient.

Mr. Charles Green, an Englishman, is reputed to have made 526 ascensions, and to have reduced ballooning to a science. The guide-rope trailing upon the ground was his invention. In Great Britain, in 1838, there were 471 professional aeronauts, and it was estimated that from 1,500 to 2,000 Englishmen had ascended.

The facilities of access to the aerial realm at desirable altitudes are directly involved in my plan for the *precipitation of rainfall*, as well as the characteristics of *rain-clouds*, and, indeed, of *all clouds and processes of their formation*. I now propose to reconnoiter the field and develop my *strategy*.

1.—METHOD OF PRECIPITATING RAINFALL.

Cloud.—A cloud denotes an accumulation of visible aqueous vapors, or watery particles, held suspended in the atmosphere at some altitude. It is embraced in a specific class of *meteorites*, which are distributed into four designated prevailing forms, viz, *cumulus*, *stratus*, *cirrus*, and *nimbus*, and their subordinate varieties, viz, *cirro-cumulus*, *cirro-stratus*, and *cumulo-stratus*.

Cumulus.—"From its structure, in convex masses, piled one upon another." (Ency. Brit.)

Stratus.—"From its being spread over the face of the sky, either uniformly or in horizontal layers." (Ency. Brit.)

Cirrus.—"From its fibrous appearance, resembling carded wool." (Ency. Brit.)

Nimbus.—"A name given to the rain-cloud."

The subvarieties denote well-defined combinations.

Selection.—It is proposed to deal with clouds in conformity with the Darwinian theory, by selection.

Nimbus or rain-clouds are condensed from aqueous vapor by the loss of latent heat, and by the force of magneto-electric action in the aerial realm.

Rain-laden clouds seldom float at a great elevation, but in conformity with the laws of specific gravity move in the most dense stratum of the atmosphere. The summits of very high mountains are frequently visible far above them. During several months the summits of the great volcanic mountains of Mexico, Orizaba, Popocatepetl, and Iztaccihuatl disclosed illustrations of this fact almost daily while under my personal observation.

The clouds most highly charged with electricity float low, often not more than six or eight hundred yards above the ground, indeed thunder-clouds often seem to rest upon the earth's surface, and clouds generally are suspended at an elevation of about a mile above the earth.

The motions of clouds are apparently governed by the wind, "but not when thunder is about to ensue." Then "they seem to move slowly, and often to be absolutely stationary for some time."

This results from the reciprocal action of the magneto-electric force between the earth and the clouds, which sometimes occasions very destructive phenomena.

There was an illustration of this in the island of Java in August, 1772.

On the 11th of that month, at midnight, a bright cloud was observed covering a mountain in the district called Cheribon, and at the same time several reports like those of a gun were heard. The people who dwelt on the upper parts of the mountain not being able to fly fast enough, a great part of the cloud, almost three leagues in circumference, detached itself under them and was seen at a distance rising and falling like the waves of the sea and emitting globes of fire so luminous that the night became as clear as day. The effects of this phenomenon were astonishing. Everything was destroyed for several leagues round; the houses were demolished, the plantations were buried in the earth, and 2,140 people were killed, besides 1,500 head of cattle and a vast number of horses, goats, and other animals. (Ency. Brit.)

So many instances of the occurrence of cyclones, waterspouts, tornadoes, and destructive thunder-bursts have been chronicled on this continent that they have become quite familar to the observant mind. In the month of October, 1844, in a vessel on Lake Superior, I had a narrow escape from a gigantic waterspout in its revolving sweep over the surface of the lake. In Florida the track of the cyclone and tornado in the forests of pine is often seen well marked by the fallen timber. To the people of Texas the destructive horrors of the cyclone which engulfed the city of Indianola, on the Gulf coast, are still remembered. These great convulsions of nature are attributable, it is believed, to the magneto-electric outbursts of action as the controlling force.

The question of safety, as well as that of expediency, is directly involved in the execution of my plan for the precipitation of rainfall from the cloud-realm. It is to be observed that a man sent on a railroad train with a velocity of sixty miles per hour, not screened from the direct resistence of the atmosphere by the cars, life would be speedily endangered. It would be as if he were thrown from a gun with that uniform velocity. His safety is insured by immersion in the atmosphere carried with him.

No man could stand on a platform-car and face the wind going a mile a minute and live. The breath would actually be blown out of his body. (New York Sun, September, 1879.)

So with the aeronaut, starting from the earth in a state of magneto-electric equilibrium, he meets the atmospheric changes as he ascends and enters the clouds in comparative safety—even by the thunder-cloud,

seldom, if ever, endangered. "It appears that M. Saussure, when traveling over one of the high Alps, was caught immersed in a thunder-cloud, and, to his astonishment, found his body so full of electric fire that spontaneous flashes started from his fingers with crackling noise and the same kind of sensation as when electrified by art." (Ency. Brit.)

On two occasions, at least, I now recall—once upon a high bluff of the upper Mississippi, and again, upon a high rolling northwestern prairie, I have been thus immersed in terrific thunder-clouds, when from their rolling, dense, black masses rain and hail deluged the ground, and incessant electric flashes illuminated these scenes so terrific and sublime.

I recall the beautiful impersonation of the cloud, by Shelley, the poet, when he says:

Sublime on the towers of my skyey bowers
Lightning, my pilot, sits;
In a cavern under, is fettered the thunder,
It struggles and howls at fits.
Over earth and ocean, with gentle motion,
This pilot is guiding me,
Lured by the love of the genii that move
In the depths of the purple sea;
Over the rills and the crags and the hills,
Over the lakes and the plains,
Wherever he dream, under mountain or stream,
The spirit he loves remains;
And I all the while bask in Heaven's blue smile,
Whilst he is dissolving in rains.

I will here note a brief account of an almost cloudless thunder storm, in Arizona. According to my own observation the scene is well painted:

AN ARIZONA PICTURE.—AN ALMOST CLOUDLESS THUNDER-STORM.

[Arizona correspondence of Chicago Tribune.]

Well, here we are, in the midst of almost a cloudless thunder-storm. One who has never been in the mountain valleys in the heated season can hardly realize how it can lighten, thunder, and rain suddenly and with little or no preparation; yet a little ugly cloud comes from somewhere, almost in a minute, and it is big with tempest. I do think this country is capable of more lightning and thunder to the minute than any other place in which I have ever been. That little cloud has spread out to about the size of two big carpets, but it is a full grown thunder-storm. It is about 3 p. m. the thermometer 105° with the sun shining brightly; but in about ten yards further it will sink behind that point of the mountain. What a magnificent bath this is! These drops are not falling so thickly as I have seen them, but they will average just about as large where they touch you as your thumb-nail. What a picture, if this trembling beauty, in the little space intervening, and the side of that mountain, drifting off into the ravine up towards the sum, could be carried to the canvas! Is it possible that these are nothing but drops of water falling through a trembling sheen of golden light? A shower of diamonds could not glisten more. Angels could not toss brighter jewels from their cabinets. I know that those are only stinted, murky green shrubs clinging to that desolate hill side; but they are the tinted background of a picture no artist-hand dare profane. How it trembles while nameless hues are drifting, changing ere you have had time to think how beautiful. And this companion-picture, brimful of worldless beauty. Why is the human easel so tame? That is the same old mountain which I descended not thirty minutes since—an old, rusty, rocky dome, but that shadow of Neptune was not there then, with that girdle of rainbow about his loins. If raindrops are brighter, here rainbows are more real, solid beauties. It cannot be a shadow only. See! it leans up against that old giant cactus, and its dismal ribs glow with shadings I dare not try to name. Now it trembles on the prickly branch of that juniper, and all its berries are changing crystals. That bolt of electric fire which just spent its fury on that old crag, and sent those bits of stones down the hill, has started an owl from his hole in the rocks, and his sombre wings are less profane while bathed in hues like those. Even his dismal twoohoo is modified as it comes to us through such a sheen. That frighted deer has just sprung into place where all this rainbow hangs upon his horns. Never was a dear little deer wrapped in such a garb before. But let me shut my eyes before this picture fades and thank the Maker for this little patch of storm.

Whether it is safe, practicable, or expedient to enter the atmospheric realm in the execution of my plan has, apparently, received already an affirmative answer from observations noticed during numerous balloon ascensions.

January 30, 1804, Mr. Sacharof, member of the Academy of Sciences, St. Petersburg, at an elevation of one and a half miles "found that, on shouting downwards through his speaking-trumpet, the echo from the earth was quite distinct, and at his height was audible after an interval of about ten seconds." (Ency. Brit.)

It would thus appear that the "phono-telegraph" is available to communicate between the earth and the balloon high above, within the cloud-realm.

On the 24th of August, 1804, MM. Gay Lussac and Biot, members of the French Academy of Sciences, "found that up to the height of 13,000 feet *the time of the vibration of the magnet was appreciably the same as at the earth's surface.*"

On the 16th of September, 1804, M. Gay Lussac ascended alone. The chief result obtained was, that the *magnetic force, like gravitation, did not experience any sensible variation at heights from the earth's surface which we can attain to.* At the height of 23,000 feet "there were still clouds above him."

Under the authority of the British Association for the Advancement of Science (1859), Mr. James Glaisher made twenty-eight balloon ascensions, "with instruments for scientific observation," for making exploration "in the upper strata of the atmosphere."

July 17, 1862, at 26,000 feet the temperature was 16° Fahr. In descending "a cloud was entered at an elevation of 12,400 feet, and proved to be more than 8,000 feet in thickness."

On the 21st of August, 1862, Mr. Glaisher found, at the elevation of three miles, the temperature was 23° Fahr., having been at the earth's surface 58° when he ascended about an hour before, at 4.30 a. m.

The aspect of the clouds under formation, before and during the rising of the sun, was marvellous in the extreme, and baffles description. There were seen shining masses of clouds in mountain chains, rising perpendicularly from the plain, with summits of dazzling whiteness, forming vast ravines down which the balloon appeared to glide or pass through their sides into other valleys, until, as the balloon rose far above, all appeared a mighty sea of white cloud.

The most noteworthy fact in connection with the ascent of September 1, 1862, was, that from the balloon the clouds were observed to be forming below, and seen to be following the whole course of the Thames from the Nore to Richmond. The clouds were above the river, following all its windings and extending neither to the right nor to the left.

This phenomenon has been observed frequently along our coasts, principal rivers, and mountain ranges.*

Again, on September 5, 1862, Mr. Glairsher claimed to have ascended 37,000 feet, seven miles, the greatest elevation ever reached. The incidents were varied and marvellous.

The assured successful ascent and flight of the balloon were well established "during the recent siege of Paris." "By it alone the communication was kept up between the besieged city and the external world, as the balloons carried away from Paris the pigeons which afterwards brought back to it the news of the provinces. The total number of balloons that ascended from Paris during the siege conveying persons and dispatches was sixty-four"; of these "only two were never heard of;

* Clouds follow rivers. I need scarcely note here that this phenomenon is of frequent occurrence on the Rappahannock and Potomac rivers, and that frequently these clouds fail to dispense much needed rainfall.

they were blown out to sea." The balloon "is estimated as one of the most valuable inventions of the last century."—(*Ency. Brit.*)

Abundant experience shows that balloon ascensions are comparatively safe, when properly directed, and that eventually every desirable facility will be attained.*

The chief characteristics of the atmosphere have for a long period been a theme for the votaries of meteorological science. I propose to enter this field as it is now presented with the design of combining the theoretical and practical.

The opinion is generally entertained that the formation or generation of clouds is dependent mainly upon changes of temperature. I assume that their formation or generation is dependent in a greater degree on magneto-electric action in the atmosphere under favoring conditions. The illustration is simple and logical, based on the indisputable evidences that polarity is a prime attribute of all matter, from the atom or molecule to the planetary sphere. The physical forces, gravitation, cohesion, adhesion, capillary attraction, molecular repulsion, light, heat, electricity, and magnetism, act upon matter in every stage or condition of its existence; chemical action designates those operations which result from the force of affinity by which the form, solidity, color, taste, smell, and action of substances become changed.

I am inclined to the opinion that the ether in space is an imponderable embodiment of magnetism as the primary unity of force emanating from the Omnipotent power, on which all other imponderable forces are planted as attributes.

The atmosphere as an elastic fluid subjected to these complex influences, involves, also, the great problem of the ages—the conditions of animal and vegetable life and vitality—as an indestructible, primeval force.

The concentration of aqueous vapor is dependent on the atomic or molecular attractive and repulsive forces of polarity pervading the aerial realm. *Gravity is not*, I feel assured, *an independent manifestation of matter*, but *an attribute of magneto-electric force, pervading "earth, air and ocean," the solar system, and the universe.*

The magneto-electric state of the earth revolving towards the east, *is negative*, while that of the atmospheric envelope, estimated at one hundred and twenty miles in depth, harmonizing in this movement, *is positive*—their reciprocal tension pervading the sunshine and the storm, the gentle zephyr and the thunderbolt.

When the magneto-electric tension of the clouds is in excess *the lightning shock is downwards;* but when that of the earth is in excess *lightning strikes upward.* Numerous instances have been noted where lightning has *completely stripped the bark from the roots and trunks and branches of trees upwards to the very extremity of their smallest twigs.* The tension in the great cyclones, tornadoes, and water-spouts often bursts from the earth upward and spreads devastation around.

"The elastic force of the atmosphere may be regarded as representing

* There is one great problem in mechanical philosophy involved, which still awaits solution. It is, in brief, the practicability of pursuing any desirable direction through the atmosphere propelled by steam, or magneto-electricity, with a facility corresponding to that now acquired in the navigation of the waters of the globe. In other words, can we apply to the air the same principles in navigation that are already applied to water?

The term momentum signifies force, or velocity acting upon inert matter. In ocean navigation the inertia is great in proportion to the propelling force or velocity. In aërial navigation the conditions are reversed, and the inertia must be light and the propelling force or velocity must be great, conditions long contemplated, which probably can be met, and thus add another step in the conquest of the cloud-realm.

approximately the absolute quantity of vapor suspended in the air." It may be termed the absolute humidity of the atmosphere. The relative humidity of the air may be regarded as the degree of approach to saturation. "It is greater near the surface of the earth during night, when the temperature, being at or near the daily minimum, approaches the dew-point. It is also greater in the morning when the sun's rays have evaporated the dew, and the vapor is as yet only diffused a little way upward, and it is least during the greatest heat of the day." An element of primeval force, "controlling *atmospheric circulation*, is aqueous vapor. It absorbs heat in evaporation, and it reappears in the process of condensation of the vapor into rain or cloud."*

It is proposed to select rain-clouds from which to precipitate rain-fall, in conformity with well-defined meteorological data. This involves the observation and approximate determination of the altitude, volume, temperature, aqueous vapor, density or barometric tension, the strength and direction of the wind, and magneto-electric condition at the time of selection.

1. It becomes necessary to observe with accuracy the local barometric tension, and to ascertain its state over a broad range of country surrounding.

2. The thermometer must be closely observed, and particularly whether it undergoes regular or irregular gradations of change.

3. The hygrometer will disclose the amount of aqueous vapor in the atmosphere and its connection with the dew-point.

4. The anemometer will disclose the strength of the wind, which is of primary importance in the selection of rain-clouds, and in conjunction with—

5. The anemoscope, determining its direction with rapid consecutive magnetic and electric observations.

In this connection, the determination of the elevation, approximately, of all clouds, and especially of rain-clouds, should be carefully noted, as well as the prevailing course of movement. It is also necessary to note the result of the contact of rain-clouds with rivers, bays, highlands, and mountain ranges, and to ascertain when they are augmented or drained.

6. The determination of the average amount of rainfall is essential; also the stage of water in rivers and the magneto-electric condition of the atmosphere. The use of the telegraph is indispensable.

To determine the orbit of movement close, rapid observations should be critically made of a thunder-cloud, embracing every characteristic—and among them, especially, consecutive magneto-electric observations—thus to determine the orbit of this class of meteors with a greater degree of precision. The meteorologists seem not to have compassed the field in this important feature.

It has been determined that aqueous vapor is not combined with atmospheric air, but mechanically mixed, occupying space, each independently of the other.

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*The incipient stages in the generation of rain-clouds still remain among the mysteries of meteorological science. On the recognized assumption that atoms and molecules, in their natural state, possess magneto-electric polarity we may found a presumptive theory on a logical basis.

The oxygen and nitrogen gases of the atmosphere possess remarkable powers of conductibility and present no impediment to free and uninterrupted magneto-electric action.

If, however, minute atoms or globules of carbon be diffused, we know already, from well-defined experiments, that a series of shocks must result from the continuous obstruction generating vapor and rain-drops, condensing rain-clouds, and vibrating thunder precipitating rainfall.

It has been estimated that the atmosphere contains about seven tons of carbon to each superficial acre—an abundant supply for the phenomenon contemplated.

The chief characteristics of the cloud-realm are greatly diversified, dependent on territorial areas, the direction of ranges of mountains, and their extent and altitude, the course, length, and volume of rivers, and the coast ranges and magnitude of adjacent seas. The fact is well established that rain-clouds seldom, if ever, flow over or across ranges of high mountains without discharging their burden of rain. This result has been observed with marked uniformity, and, indeed, it is assumed that no cloud carries a large amount of aqueous vapor at an elevation of over 12,000 feet from the surface, and that it is greatly diminished in approaching that limit. Hence, we derive a logical conclusion that the high mountain ranges on this continent perform the important function of standing barriers, draining the flowing rain-clouds and distributing their incumbent waters among rivulets, streams, and bounding rivers, flowing through valleys, table-lands, and broad alluvial plains to the ocean.

It has been noted that no rain-cloud generated on the Southern Atlantic, flowing westward over Brazil, crosses the Andes, in South America, without having been completely drained. On the Pacific slope it seldom rains. A much lower ridge than the Andes may intercept the entire moisture of the atmosphere, as has been shown "by well-known phenomena in India, where the Ghauts, a chain only 3,000 to 4,000 feet high, divide summer from winter, as it is called; that is, they have copious rains on their windward side, while on the other the weather remains clear and dry, and the rains regularly change from the west side to the east, and *vice versa*, with the monsoons." (Ency. Brit.)

The great volcanic mountains Popocatepetl, 17,884 feet high, and Orizaba, 17,373 feet high, of Mexico, seldom show the snow-line at less than 6,000 to 8,000 feet below their summits, varying with the seasons.

I am inclined to the opinion that, on the average, at an altitude of over 12,000 feet the aqueous vapor in rain-clouds is congealed and dispensed in snow-storms. At greater altitudes cold wintry fogs and dry cirrus clouds may at times obscure the skies.

In the extensive region lying between the parallels of 30° and 50° N., which comprehends three-fourths of the useful soil of North America, we have three well-marked varieties of climate: that of the east coast, that of the west coast, and the basin of the Mississippi. (Ency. Brit.)

The coast of the Gulf of Mexico comes apparently within the last-noted climate, but in reality the Gulf coast of Texas, in its complete outlines, discloses climatic influences peculiarly its own.

The trade-winds sweeping over the waters of the Gulf, inland, condense rain-clouds almost continually, which float above the low coast-line, disclosing the strongest evidences of impending rainfall, and yet they are driven inland, gradually ascending from contact with somewhat warmer strata of dryer rarefied air, and not unfrequently reaching the high lands of Northern Texas before dispensing much-needed showers. This is no fancy-drawn illustration, but one of the most frequent realizations. These floating rain-clouds, apparently heavily laden with aqueous vapor, are seen almost daily passing over inland districts suffering on account of too-long-deferred rainfall. Such has been the prevailing condition in the cloud realm embracing extended areas in the State of Texas during several months preceding the month of April, 1879.

Having thus noted prevalent conditions of the atmospheric realm and the scientific methods for their determinations, I now propose to explain my plan for precipitating rainfall from rain-clouds by mechanical means in combination with chemical explosive force. To give an illustration in explicit terms, I assume a case of well-ascertained conditions. I sup-

pose that a rain-cloud 5,000 feet in depth, of proportional length and breadth, saturated with aqueous vapor, floats at an elevation of 5,000 feet above the city of Austin, Tex., where apprehension exists of an impending drought, and that the meteorological conditions favor rainfall. I propose to employ all available scientific inventions to precipitate rainfall, and—

First. A small balloon to carry, in ascending, ten small torpedoes, or cartridges, each charged with one-half pound of dynamite, arranged for simultaneous magneto-electric explosion.

Second. Let the small balloon, in ascending, carry up a copper-wire trailing drag, reaching the ground from the rain-cloud at any desired altitude, arranged to explode or detonate the torpedoes or cartridges by magneto-electric force, to produce a shock, concussion, and vibration to precipitate rainfall.

I propose thus to employ the separate or combined powers of chemical and mechanical science in analogous fields of action.

Small balloons may be employed in groups in the cloud-realm for simultaneous explosion or detonation by electric or mechanical force, as well as with the well-tried "time-fuse."

I further propose to employ the regular balloon, directed by an aeronaut, to reconnoiter the cloud-realm, to trail torpedoes and cartridges, or to throw them in parachutes, and to explode or detonate them either from the balloon or from the ground. It is contemplated to employ nitro-glycerine, dynamite, chlorates of nitrogen, gun-cotton, gunpowder, fulminates, and other explosives, and to use the magneto-electric telegraph on the surface and the phono-telegraph in the cloud-realm, to direct action.

The magneto-electric telegraph may be used also to explode and detonate torpedoes and cartridges. It is contemplated not only to precipitate rainfall, but also to check its fall in overabundance; and also to purify and renovate the atmosphere over cities during periods of pestilence and epidemics.

This invention is based on discoveries in meteorological science, and that magneto-electric force sways and controls the atmospheric realm, and governs the movements of the rain-clouds, bursting into thunder-storms, dispensing rain and hail—into cyclones and tornadoes, illuminated by magneto-electric forces, as prime attributes of matter.

I propose to employ the magneto-electric engine to send explosions into the cloud-realm, and compressed air and steam into the atmosphere, whenever found expedient, each through its appropriate medium of metallic wire, textile fiber cordage, and elastic tubes.

The cloud-realm remains, thus far, beyond the conquest of human genius; and yet is placed, apparently, by the Omnipotent hand within the sphere of man's mental and physical vision, inviting persistent exploration. The invention now proposed contemplates a combination of mechanical and chemical forces for the inauguration of a practical plan of exploration, with a view to appropriate the atmospheric laws of cloud-land, in sunshine and in storm, and direct them, so far as may be practicable, within the sphere of the great industrial interests and energies of man, and especially so to sustain vegetation and to equalize the water-flow of streams and rivers in harmony with systems for extensive irrigation as well as to facilitate navigation.

The field is broad—very broad; as deep as it is broad—it is very deep! But when we contemplate the triumphs of American genius within the present century, there is abundant reason to anticipate untold advancement. The theory involves the whole round of philosophic principles, as well as an unlimited field for observation.

The great battles of Europe often precipitated rainfall; the great battles in our recent civil war were noted for having precipitated abundant rainfall; and it has been conceded that the repeated consecutive powerful explosions during many of the great battles of the world have been attended with abundant rainfall. Volcanic eruptions, cyclones, tornadoes, city conflagrations, forest and prairie fires, and sweeping winds have been reputed to have condensed rain-clouds and to have precipitated rainfall.

We are admonished that the aerial realm presents, comparatively, an unexplored field for scientific research to the age in which we live, and that when the important interests it discloses are contrasted with those involved in Arctic exploration—in which human life, energy, and treasure have been lavished in vain attempts thus far to penetrate the ice-bound zone which envelopes the North Pole—it would seem that the immense regions of cloud-land present a more important as well as a more inviting field for the employment of capital and manly enterprise—holding in view the ethical rule of "the greatest good to the greatest number."

That distinguished pioneer in meteorological science Professor Espy limited his field of action to the earth's surface instead of attempting to ascend into the atmospheric realms, and, indeed, he did not then find in his path the triumphant march of the great modern inventions. The gigantic stride of the engineer through the cloud-capped mountains, and with miraculous force rending asunder the foundations of old ocean's bed; the modern "Prometheus," magneto-electric lightning, had not then been enchained; the leviathan "steam" had not then been bound to the billowy ocean's foam; aerial navigation sat with clipped wings in the portals of the temple of science; the grand triumphs in chemical philosophy in the development of explosives; in the condensation of the elements of light in the photographic art; the development of mines of vast extent and fabulous wealth; the unfolded banner of meteorological science—no, none of these grand revelations of occult science were available to him. They had then scarcely dawned upon the horizon of the human mind.

The term "explosion" signifies the instantaneous conversion of solid or liquid matter, in small dimensions, into gas or vapor, of a greatly increased volume, expanded by heat evolved, generating force. It is important to distinguish between the *explosive force* and *the explosive effect.*

The explosive effect of gunpowder being taken as a unit, or one (1.00), gun-cotton is three (3.00), and nitro-glycerine is four and eighty-hundredths (4.80), and *their explosive force* is 1.00, 3.06, and 4.55, respectively. The most violent explosives are more limited in their effects, yet are often preferred when detonated. The potential energy of explosives, as well as coal, has been measured, approximately, by the evolution of the force, per pound, to raise one ton to the height of one foot, and is designated "per pound" so many "foot tons." The potential energy of gunpowder is 480, of gun-cotton, 716, of nitro-glycerine, 1139, while that of one pound of coals is about 4980! "foot tons." (Curtiss and Maury.)*

*The following table, exhibiting the relative intensity of action of several of the modern explosives when exploded under water in torpedo cases, is given as a sample of the work:

Dynamite, No. 1	100
Gun-cotton	87
Dualin	111
Rendrock	94

The very marked characteristics disclosed by explosives seems to warrant a suspicion that they hold condensed, if not solidified, magneto-electric force as a prime attribute of matter even in its most inert condition. In this, as well as in the entire field of chemical philosophy, its presence as a vital element will, in the coming time, probably be demonstrated. The successful employment of explosives in blasting tunnels through mountains, and in deep mining, and in submarine explosions, may be truly classed among the modern triumphs of genius.

Those among us of mature age may recall that, soon after its discovery, nitro-glycerine was exploded very effectively by magneto-electricity, demolishing the submerged rocks in the channels of rivers and harbors. The resistance to the explosive force was dependent on the relative weight or density of the rock stratum and that of the incumbent waters.

Since the employment of compressed air for tunneling the submarine rock-bed, the employment of explosives within the rock has been found far more effective. Recently nitro-glycerine and its derivative, dynamite, have been exploded to crush rocks upon the surface under the superincumbent atmosphere. In this case the momentum of resistance is dependent on the relative density of the rock and the atmospheric air instead of water. I now propose to follow this analogy one step further and to detonate explosives immersed in the atmospheric realm, in the midst of a central pressure of uniform density of some fourteen pounds to the square inch of surface. The resultant effect is illustrated by the explosion of heavy guns upon the ground, and in the aerial realm by the magneto-electric explosions of the thunder-cloud! I must claim that this analogy is strictly logical, and rests on rigid scientific deductions.*

Dynamite, No. 2	83
Vulcan powder	82
Mica powder	83
Nitro-glycerine	81
Hercules powder, No. 1	106
Hercules powder, No. 2	83

It should be added that, for various reasons not necessary to discuss, the board is agreed that dynamite No. 1 should be adopted for our service.

The report notices also a simple dynamite electric machine made by the Laflin and Rand Powder Company as admirably adapted for use as a portable igniting apparatus for torpedoes and heavy ordnance—carefully tested for two years—cost twenty-five dollars.—(Report of Chief of Engineers, 1879.)

* The concussion of atoms at the union of eight pounds of oxygen with one pound of hydrogen sets free an amount of energy in the form of heat equivalent, in mechanical value, to 47,246,400 pounds let fall one foot, or the crash of a ton's weight as an avalanche down a precipice of 23,623 feet.—(L. R. Curtiss.)

MOLECULAR DYNAMICS.

Conservation of energy was denominated by Faraday as "the highest law in physical science which our faculties permit us to perceive." Its unfoldings mark an intellectual epoch which divides the old from the new. It teaches of the unity of the universe; it tells us how the sun's rays constitute the mighty energies of daily life and action upon every hand, warming, illuminating, and vivifying the surface of the globe.

ELECTRIC FORCE.

A cubic foot of water yields 1,852 cubic feet of the separate gases when at normal condition, and no human device is competent to overcome this expansion by pressure sufficient to reduce them back again to the liquid condition. Upon the evidence of Faraday, we have it that "the decomposition of a single drop of water by electricity calls for an expenditure of more electromotive force than would suffice to charge a thunder cloud."

FIELD OF DISCOVERY OF NEW EXPLOSIVES.

If we assume that the powerful explosives now in use consist of a condensation of of magneto-electricity, analogy teaches that we have taken a preliminary step only

Sending torpedoes and cartridges charged with explosives by balloons into the cloud-realm has been already maturely considered, and the method of exploding from the earth's surface through a magneto-electric circuit is of undoubted practicability.

The question is thus squarely presented whether we have sufficient knowledge of high "explosives" and the methods of their "detonation" to insure safety in their employment. Abundant evidence enables us to answer in the affirmative. General Newton exploded simultaneously 3,600 charges of dynamite in the submarine demolition of Hell Gate, at 2,200 feet distance from his firing-station. He used a cylindrical tin shell, 2 inches in diameter and 6 inches in length, charged with three-fourths of a pound of dynamite in each shell. The explosion was signally successful.

The principle involved in the detonation of the standard fuse is explained as follows: "Whenever a galvanic current passes through a wire it meets a certain fixed resistance, in overcoming which the energy expended is converted into an equivalent amount of heat".—J. H. Striedinger, C. E. This property possessed by the current is utilized in the low-tension fuses, the priming of which is fired by heating a fine wire stretched across the ends of two copper wires, whose open ends are connected with the poles of the battery. "A platinum-silver bridge of 0.0014 inch diameter and $\frac{4}{16}$ inch in length" has been found effective.

Magneto-electric force, "flowing through a perfect conductor, no matter what the strength of the current may be, neither heat nor light would be developed. A rod of unresisting copper carries away uninjured and unwarmed an atmospheric discharge competent to shiver to splinters a resisting oak."—Professor Tyndall. "Send the self-same current through a wire composed of alternate lengths of silver and platinum. The silver offers little resistance, the platinum much. The consequence is that the platinum is raised to a white heat, while the silver is not visibly warmed."

The magneto-electric circuit copper-wire should not weigh less than one pound, and, probably, not exceed two pounds for one hundred yards. Sending explosives into the cloud-realm, atmospheric electricity may precipitate the detonation of torpedoes and cartridges.

"The rate of detonation of spaced dynamite masses is 6,239 feet per second," showing that the explosion of a group of torpedoes, simultaneously, in a rain-cloud, must vibrate throughout our aerial horizon.

Furthermore, I propose to propel by steam the magneto-electic engine, and the compressed-air engine, in the conquest of the cloud-realm, the better to comply with the divine injunction to "replenish the earth and subdue it."

In the prosecution of this invention there is no thought of transcending man's legitimate sphere of action, but rather a laudable purpose to utilize the grand resources of the atmospheric realm, in which, already,

in the development of that tremendous force, and that we may yet eliminate one so potent as to cause vibration throughout our visible horizon.

We may also assume that explosive force in the atmosphere produces a momentary vacuum, followed by the recoil or reflux of the aerial gases with a velocity and force equal to that of the applied explosive force. This fact is fully illustrated daily by the record of barometric and other meteorological changes.

The axiom that "nature abhors a vacuum" is exemplified in the realm of atmospheric laws as its specific field of action.

A potent explosive force in the cloud-realm must, in its rebound, condense vapor in clouds as well as reaction in the shock and vibration in the atmosphere. This is one among the immutable laws of the elements of matter.

his genius and enterprse have made conquest of so many great elementary powers of nature.*

In the midst of abundant waters, those magic solvents of the fertilities of the soil, provided by the Omnipotent Hand, in vast areas of the globe there prevails to-day desolating drought, and voices of lamentation are borne on each passing breeze and wafted gently to the land of sighs! There is famine in Brazil, resulting from drought, producing "plague, pestilence, and famine." There is famine in the British Indian Empire, which has prevailed already for some years without material mitigation, defying the stringent exercise of British power, millions of natives having died already under every conceivable form of heart-rending agony, sending a wail of suffering, sorrow, and lamentation throughout the arid plains of India. There is famine in China, sweeping millions from their native soil, disclosing horrors surpassing the powers of language to describe, and in its most terrible forms death still revels unchecked. There has been widespread drought and the land still withholds its increase! Is this a special dispensation of Providence upon intensely civilized barbarians? Is it not rather that nature's genial laws have been temporarily suspended—that these disasters to the human race have arisen from local disruptions of the great atmospheric laws—their disturbance throughout broad areas of the Chinese Empire? It has been always so. There has been famine in Peru; there has been famine in Brazil; there has been famine in Ireland; there has been famine in Egypt; there has been famine in India; there has been famine in Asia; there has been famine in China; and, indeed,

*NOTE.—We cannot fail to note the declaration of our Saviour, that "The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, and whither it goeth." (John iii, 8.) During long ages this divine maxim has been the basis of interpretation of the mysterious laws of the aerial realm. It has been reserved to the votary of modern meteorological science to interpret these laws with persistent industry which has already resulted in marvelous revelations.

We still find among the marvels of tradition an abiding faith that rainfall comes almost exclusively within the scope of those special providences within the jurisdiction of church discipline, and not directed by those great natural laws implanted by the Omnipotent hand before the creation of man. On this dogma the canons of the theologians have long been planted, with which artillery they have bombarded the moral atmosphere—as the basis of hope not realized.

By degrees the genius of man, moving in its predestined sphere, has interpreted these great natural laws and eliminated principles as permanent as the foundations of the solar system, and, indeed, of the universe.

Abundant evidence has been accumulated that the manifestations of the great principles of physical nature are relative. Caloric, or heat, is relative in degree. On this principle is founded the artificial production of ice in warm climates, and, indeed, on which the seasons revolve.

Magneto-electric force has only been recently developed for industrial employment as a great motor of the atmospheric realm.

Light, as a primitive element of matter, has been only within the memory of man condensed in photography.

Steam, the most potent motor known, is of modern industrial application.

Thus scientific revelation gradually advances in the conquest of the cloud-realm, unfolding those latent powers of material nature which, from the primeval ages, swayed a superstitious world.

Thus we define the limits of demarcation between the moral and physical creation—harmonized under the great fundamental laws of mind and matter. While the theologian explodes torpedoes in the moral realm, the engineer rends asunder the rock-bound ocean-bed of far-famed Hell-Gate! Each moves in his legitimate sphere. The advance step in the science of meteorological engineering of exploding torpedoes in the cloud-realm to condense clouds, and by their shock and vibration precipitate rainfall, is founded on strictly logical deductions and abundant observation upon numerous battle-fields and the constantly recurring atmospheric disturbances. It possesses the presumptive advantage over the theological method in this fact, that it has never been so persistently tried and so notably to have failed! In what time, indeed, would our theological torpedoes have riven asunder the ocean's rocky bed at Hell-Gate!

there has been famine throughout the European and Oriental world! Who can tell that the people of this Heaven-born republic, thus far a verdant land of abounding plenty, may not in the vicissitudes of the coming time be overwhelmed with "plague, pestilence, and famine"!

There is no natural law of obstruction—there is no promise of divine exemption! Would it, then, be an act of wisdom, when a scourge shall be impending, to indulge in dreams for the interpretation of some inspired, patriarchal Joseph, and to search for some Egyptian land as the means of alleviation for suffering and sorrow? Shall we, then, obtain corn from overburdened Europe or from the over-populous Oriental nations beyond our western border? Ah, no! The career of Joseph foreshadowed the *Christian dispensation.* Since then, under the providence of God, the material world has been illuminated by *scientific revelation!* We are admonished to concentrate these miraculous powers in the development of the great field of man's material welfare, "to replenish the earth and subdue it."

The question is now presented—

Where shall the nations get their food? The most serious question that has ever been presented to the statesman of the age is one that will soon be forced upon them for solution. It is one that cannot be passed by, that cannot be ignored. It must be met, because its demand to be is so imperative; because life or death must be the result of its issue. It is the question of where shall the food be obtained for the inhabitants of the world?

The anxious query is heard throughout Europe; it rises again in Northern Africa; it is echoed from Persia; it re-echoed from Hindostan, and China swells the universal cry. The wheat-crop, on which mankind have for long years past relied for their food supply, is this year short over the world to the enormous amount of from 300,000,000 to 350,000,000 bushels! There is no known source of other food upon which to rely for this startling deficiency. Are the people to starve? Is a universal famine about to fall upon the human race, with all the attendant horrors of starvation and suffering?

This is no sensational inquiry; it is no exaggerated view of the case. It is founded upon facts and figures, which show with undeniable force the alarming truth that while in the United States the food supply is this year ample and wondrously abundant, in all other nations there is not enough to feed the hungry and to support the existence of the masses. To verify our statement we present the figures upon which it is based.

The total average production of the world reaches the quantity of 1,630,000,000 bushels. The producing countries in favorable years are the United States, which produces 360,000,000 bushels; France, 280,000,000; Russia, 220,000,000; Germany, 120,000,000; Spain, 116,000,000; Italy, 107,000,000; Austro-Hungary, 102,000,000; United Kingdom, 94,000,000; Turkey, 40,000,000; Roumania, 35,000,000; Algeria, 25,000,000; Belgium, 24,000,000; Holland, 5,000,000; Bavaria, 20,000,000; Canada, 20,000,000; Egypt, 8,000,000; Portugal, 8,000,000; Greece, 5,000,000; Servia, 4,000,000; Denmark, 3,000,000; Sweden and Norway, 3,000,000; Switzerland, 2,000,000; all others, 9,000,000.

The estimated requirements for Europe only, amount to 280,000,000, and this estimate is under rather than over the actual demand. Great Britain will need 120,000,000 bushels; France, 100,000,000; Southern Europe, 25,000,000; Holland, Belgium, and North Germany, 25,000,000; Denmark, Norway, and Sweden, 10,000,000. Add to this array of figures the demands for the Asiatic and African people, and the truth of the deficiency becomes painfully corroborated.

That there will, until the next crop is produced, be a vast amount of suffering in those parts of the world that are the most poorly supplied with food, there can be no doubt. The records of the present famine existing in Hindostand, Persia, and China are replete with all the horrors of a starving multitude. How much nearer home it will come to us when the wail of unappeased appetite shall rise from our European brothers!

The food of the world is rapidly approximating the capability of supply. It is a subject which will call for the attention of the ablest minds of the age, to aid in the solution of the problem as to how the requisite food shall be obtained.—(*San Francisco Independent.*)

The conformation of our continent, crowned with its lofty mountain ranges, its great bounding rivers, its broad fertile plains, and its boundless forests—all swept by the rain-clouds of surrounding oceans—all, all give assurance that a combination of skill and industry will materially

protect our soil from impending drought, and from those visitations of desolating famine so often chronicled in the eastern world.

By thus scanning the vicissitudes ever impending we discover the magnitude of the contingencies we may be doomed to meet; and in the event of success in this plan for precipitation of rainfall we also disclose the notable fact that no other scheme of philanthropy known to man—save that embodied in the Christian dispensation—transcends it!

Your petitioner respectfully asks that Congress will appropriate the sum of ten thousand dollars, to be expended under the direction of the Commissioner of Agriculture in the practical development of this proposed method of precipitating rainfall from the aerial realm.

DANIEL RUGGLES.

CITY OF FREDERICKSBURG, STATE OF VIRGINIA,
December, A. D. 1879.